



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/018,401	04/10/2002	Nguyen Hoang Tran	P07472US00/WEJ	1198

881 7590 11/05/2003

LARSON & TAYLOR, PLC
1199 NORTH FAIRFAX STREET
SUITE 900
ALEXANDRIA, VA 22314

EXAMINER

SONG, MATTHEW J

ART UNIT PAPER NUMBER

1765

DATE MAILED: 11/05/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/018,401

Applicant(s)

HOANG ET AL.

Examiner

Matthew J Song

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 August 2003.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 18-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 18-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Specification

1. The amendments to the specification filed 8/22/2003 has not been entered because it does not conform to 37 CFR 1.125(b) and (c) because: the statement as to a lack of new matter under 37 CFR 1.125(b) is missing.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 18-30 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 18 recites, "wherein the single source precursor flow and the substrate temperature are selected so that the II-VI semiconductor film that is deposited on the single crystalline substrate is epitaxial" in the last 3 lines. There is no support in the original specification for selection of parameters for epitaxial deposition as claimed. The specification is completely silent to precursor flow.

4. Claims 18-30 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described

in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 18 recites, "providing a single crystalline substrate suitable for epitaxial film growth with a structure and lattice constant which approximates that of the II-VI semiconductor film" in lines 3-5. The original specification merely teaches Si (111) has lattice mismatch of 0.2% (pg 4, ln 30-35), but does not discuss the broadly claimed limitation for the selection of a substrate with a lattice constant and structure, which approximates the II-VI semiconductor.

5. Claims 27-28 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 27 recites, "the initial step of cleaning the single crystalline substrate which included repeated cycles of rinsing in H₂O. There is no support in the original specification for an initial step or repeating cycles of rinsing in H₂O. The specification merely teaches a cleaning process using H₂O, note Table 1.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claim 27 recites the limitation "the initial step of cleaning" in lines 1-2. There is insufficient antecedent basis for this limitation in the claim.

Claim Objections

8. Claims 27-28 are objected to because of the following informalities: Claim 27 recites, “the initial step of cleaning” in lines 1-2, which lacks antecedent support. Likewise for claim 28 in lines 4-5. Appropriate correction is required.

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 18-26 and 29-30 are rejected under 35 U.S.C. 102(b) as being anticipated by Nomura et al (“Single source MOVPE of Zinc Sulfide Thin Films Using Zinc Dithiocarbamate Complexes”).

Nomura et al discloses a (111) oriented cubic zinc sulfide (ZnS) thin layer, this reads on applicant’s epitaxial film, grown on a Si(111) substrate, this reads on applicant’s single crystalline substrate with a structure and lattice constant which approximates that of the II-VI semiconductor, by MOVPE using zinc Bis(diethyldithiocarbamate) (Abstract). Nomura et al also discloses washing of the surface of the substrate, heating the substrate to 200-450°C and heating a source of zinc Bis(diethyldithiocarbamate) to 25-300°C (pg 5). Nomura et al also discloses the optimum source temperature is 200°C and the optimum substrate temperature is 400°C (pg 6).

Referring to claim 18, Nomura et al discloses a high quality zinc sulfide layer (pg 4) and the zinc sulfide layer is a strongly (111) orientated film (pg 6), this reads on applicant's epitaxial film. Furthermore, Nomura et al discloses a similar method of forming a high quality zinc sulfide layer using similar temperatures and precursors, as applicant, therefore the film taught by Nomura et al is inherently epitaxial. Nomura is silent to the precursor flow and the substrate temperature are selected to deposit an epitaxial film. This is inherent to Nomura et al because Nomura discloses parameters, which inherently form an epitaxial film.

Referring to claims 29-30, Yoneda inherently discloses a ZnS epitaxial film. Furthermore, the claims are product-by-process claims and the patentability determination of a product-by-process claim is based on the patentability of the product and does not depend on the method of production (MPEP 2113).

11. Claims 18, 19, 23, 27, and 29-30 are rejected under 35 U.S.C. 102(b) as being anticipated by Yoneda et al (*The Preparation of Conductive ZnS Films by Using MBE with a Single Effusion Source*).

Yoneda et al discloses epitaxial ZnS films grown on the (001) or (111) face of substrates have a cubic structure (Abstract and pg 133 Conclusion) and GaP, Si or GaAs are suitable substrates (pg 125 Introduction). Yoneda et al discloses high purity ZnS was used as a source material and evaporated from a single effusion cell (pg 126 Experiment). Yoneda et al discloses etched and rinsed in water to remove an oxide layer (pg 126 Experiment). Yoneda et al discloses ZnS growth at 200-320°C (pg 129).

Referring to claims 29-30, Yoneda discloses the process and an epitaxial film.

Furthermore, the claims are product-by-process claims and the patentability determination of a product-by-process claim is based on the patentability of the product and does not depend on the method of production (MPEP 2113).

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

13. Claim 24, 25 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoneda et al (The Preparation of Conductive ZnS Films by Using MBE with a Single Effusion Source”).

Yoneda et al discloses all of the limitations of claim 24, as discussed previously, except the temperature of the substrate.

The selection of reaction parameters such as temperature and concentration is obvious (In re Aller 105 USPQ 233, 255 (CCPA 1955)). Therefore, It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Yoneda et al to optimize the temperature to obtain same by conducting routine experimentation because temperature is held to be obvious (MPEP 2144.05).

14. Claims 27-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nomura et al ("Single source MOVPE of Zinc Sulfide Thin Films Using Zinc Dithiocarbamate Complexes") as applied to claim 18-26 and 29-30 above, and further in view of Suzuki et al (US 6,107,197).

Nomura et al teaches all of the limitations of claim 27, as discussed previously, except repeated cycles of rinsing in H_2O .

In a method of cleaning a Silicon substrate, note entire reference, Suzuki et al teaches an AMP cleaning is performed for 10 minutes to remove organic substances and particles from the silicon substrate surface and then rinsed in pure water to remove the first chemical from the silicon substrate surface. Suzuki et al also teaches a HPM cleaning is then carried out to remove heavy metals and then rinsed in pure water to remove the second chemical from the substrate surface. A DHF cleaning is then performed to remove a spontaneous oxide layer from the silicon substrate surface, which is followed by a water rinse to remove the solution from the substrate surface (col 14, ln 1-65). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Nomura et al with Suzuki et al's cleaning process to remove particles, organics, metals and oxides from the surface of a substrate, which improves epitaxial growth thereon.

Response to Arguments

15. Applicant's arguments with respect to claim 18 have been considered but are moot in view of the new ground(s) of rejection.

16. Applicant's arguments filed 8/22/2003 have been fully considered but they are not persuasive.

Applicant's arguments against the Nomura reference are noted but are not found persuasive. Applicant alleges that the fact that cubic ZnS films on cubic Si (111) were only obtained using a carrier gas, which supports the precursor flux would suggest that the formed films are clearly not epitaxial. This is viewed as mere attorney argument, which lacks evidence and therefore is not found persuasive. Furthermore, it is unclear how a carrier gas would suggest a non-epitaxial film because the carrier gas is used to produce high quality films (Nomura pg 5).

Applicant's also alleges that without the carrier gas, the films grown were hexagonal. The examiner agree with this point, however Nomura is directed to using a carrier gas to produce high quality cubic ZnS, which is the basis of the rejection.

Applicant also alleges the growth conditions of Nomura teach away from the epitaxial growth. This is viewed as mere attorney argument, which lacks evidence and therefore is not found persuasive.

Applicant's argument that Nomura does not teach an epitaxial film growth is noted but is not found persuasive. The Examiner admitted that Nomura does not teach an epitaxial film, however the Examiner maintains this feature is inherent because the ZnS is strongly oriented to

(111) and the substrate is Si (111). Based on applicant's definition of epitaxial that the epitaxial film grows with the same or similar crystallographic structure that the substrate has, Nomura's cubic ZnS (111) on a Si (111) substrate reads on an epitaxial layer because the ZnS layer has the same orientation as the substrate. Furthermore, Yoneda et al disclose cubic ZnS films are epitaxial on substrates.

Applicant's argument that the growth conditions taught by Nomura et al teach away from an epitaxial film is noted but is not found persuasive. Nomura et al teaches similar growth conditions claimed by applicant. It is unclear how the conditions of Nomura teach away from an epitaxial film. Applicant has not provided evidence to show the film taught by Nomura is not epitaxial and would not inherently be epitaxial.

Conclusion

17. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Nishio et al (US 6,211,043) teaches a metal organic compound of Zinc dithiocarbonate (col 7, ln 35-55) and vaporizing the organic compound to form a compound semiconductor (*claim 1*).

Suzuki et al (US 6,228,166) teaches APM is used to remove native oxides from silicon substrates, which is followed by a water rinse (col 6, ln 10-40).

Fitch et al (US 5,308,788) teaches native oxide hinders epitaxial growth (col 3, ln 60-65).

18. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 703-305-2667. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Matthew J Song
Examiner
Art Unit 1765

Application/Control Number: 10/018,401
Art Unit: 1765

Page 11

MJS



ROBERT KUNEMUND
PRIMARY EXAMINER